FIG. 1

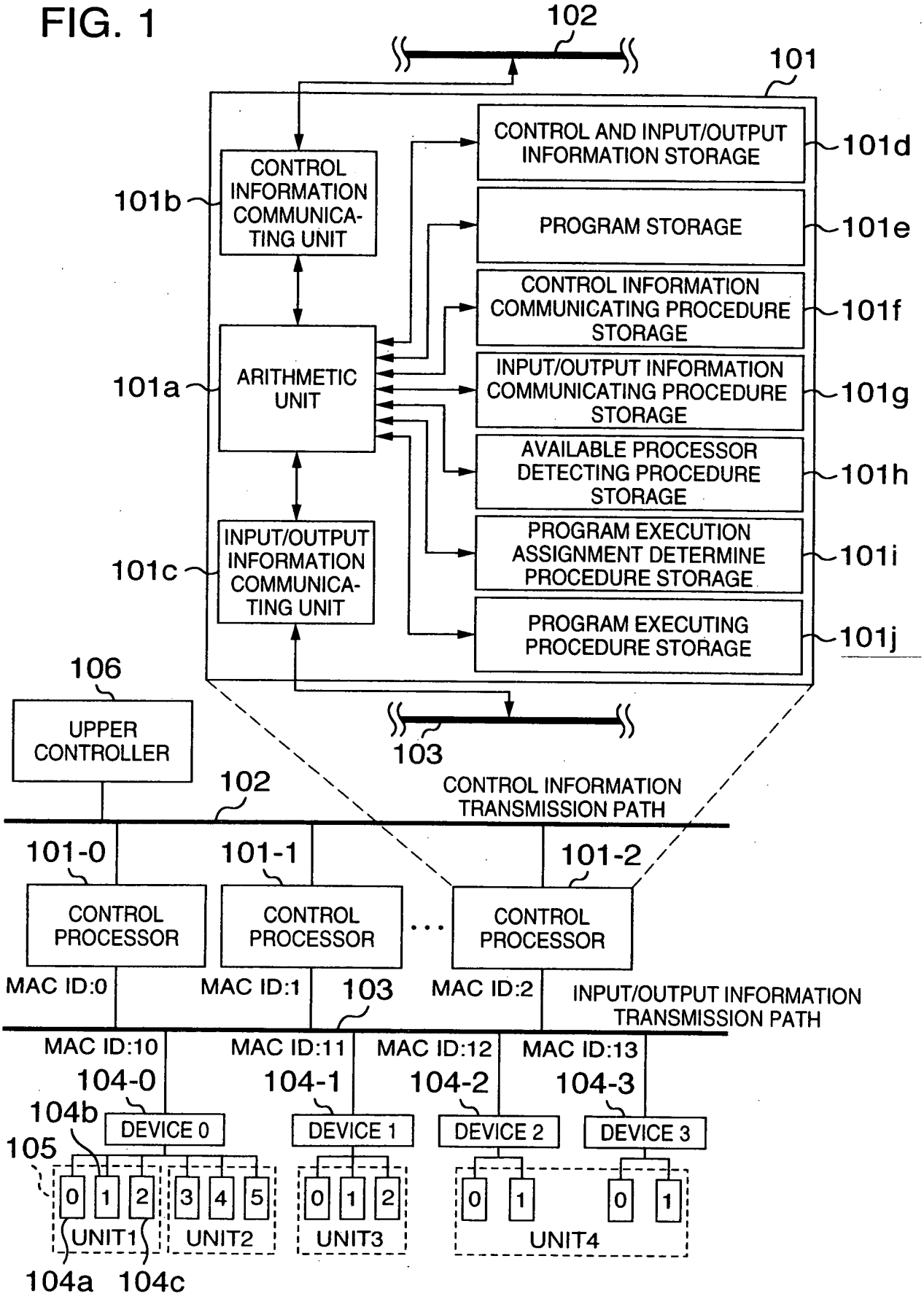
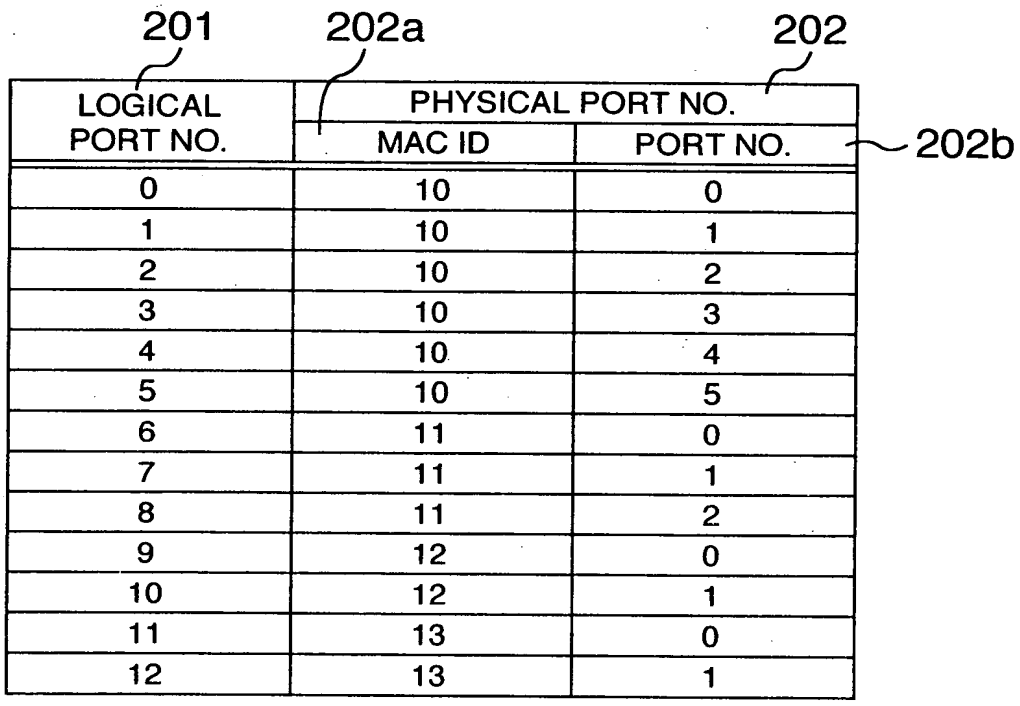

102
101
CONTROL AND INPUT/OUTPUT INFORMATION STORAGE
101d
CONTROL INFORMATION COMMUNICA-TING UNIT
101b
PROGRAM STORAGE
101e
CONTROL INFORMATION COMMUNICATING PROCEDURE STORAGE
101f
ARITHMETIC UNIT
101a
INPUT/OUTPUT INFORMATION COMMUNICATING PROCEDURE STORAGE
101g
AVAILABLE PROCESSOR DETECTING PROCEDURE STORAGE
101h
INPUT/OUTPUT INFORMATION COMMUNICA-TING UNIT
101c
PROGRAM EXECUTION ASSIGNMENT DETERMINE PROCEDURE STORAGE
101i
PROGRAM EXECUTING PROCEDURE STORAGE
101j
106
UPPER CONTROLLER
103
102
CONTROL INFORMATION TRANSMISSION PATH
101-0
101-1
101-2
CONTROL PROCESSOR
CONTROL PROCESSOR
CONTROL PROCESSOR
MAC ID:0
MAC ID:1
103
MAC ID:2
INPUT/OUTPUT INFORMATION TRANSMISSION PATH
MAC ID:10
MAC ID:11
MAC ID:12
MAC ID:13
104-0
104-1
104-2
104-3
104b
DEVICE 0
DEVICE 1
DEVICE 2
DEVICE 3
105
0 1 2
3 4 5
0 1 2
0 1
0 1
UNIT1
UNIT2
UNIT3
UNIT4
104a
104c

FIG. 2



LOGICAL PORT NO.	PHYSICAL PORT NO.	
	MAC ID	PORT NO.
0	10	0
1	10	1
2	10	2
3	10	3
4	10	4
5	10	5
6	11	0
7	11	1
8	11	2
9	12	0
10	12	1
11	13	0
12	13	1

FIG. 3

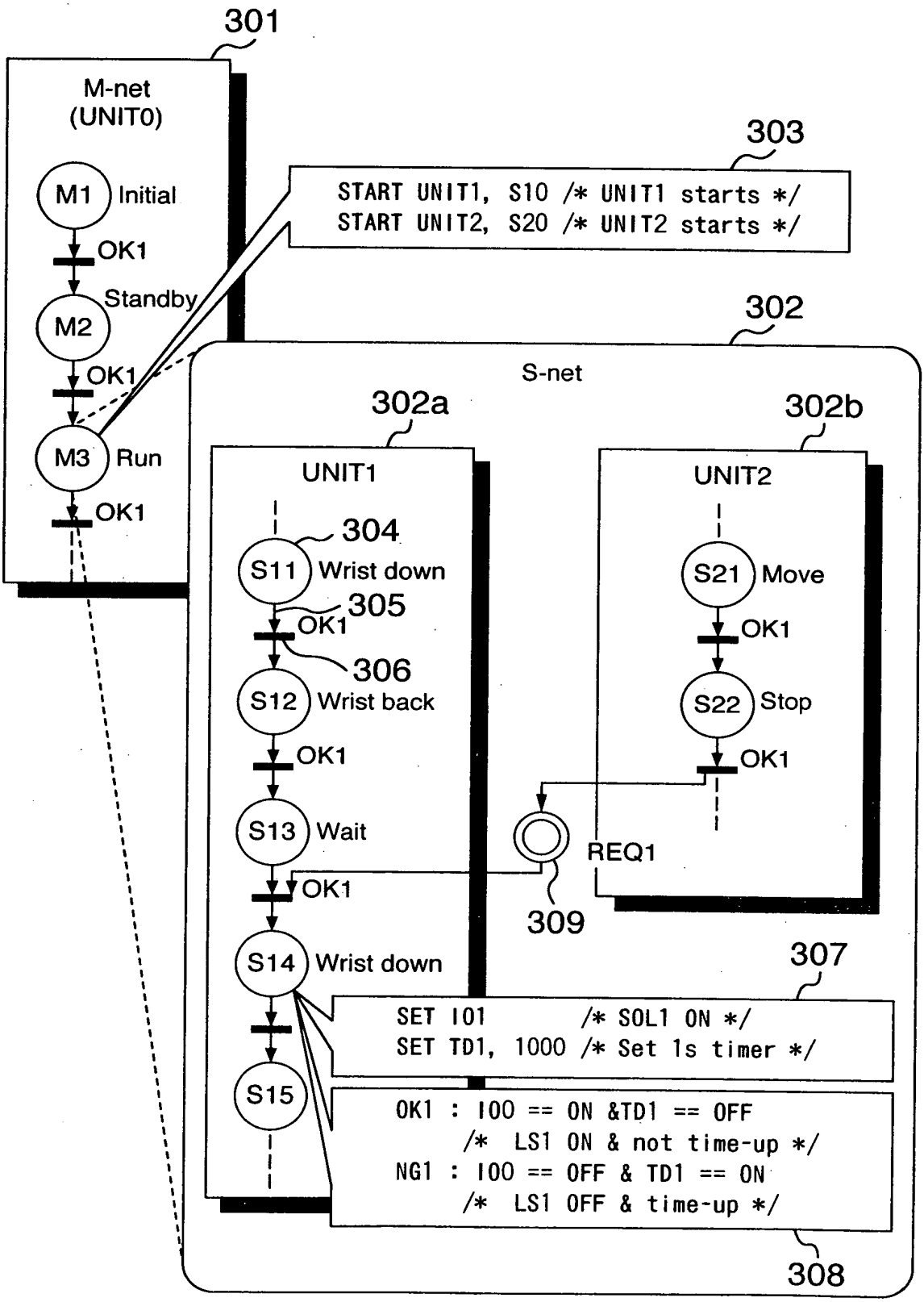

301
M-net
(UNIT0)
M1
Initial
OK1
Standby
M2
OK1
M3
Run
OK1
303
START UNIT1, S10 /* UNIT1 starts */
START UNIT2, S20 /* UNIT2 starts */
302
S-net
302a
UNIT1
304
S11
Wrist down
305
OK1
306
S12
Wrist back
OK1
S13
Wait
OK1
S14
Wrist down
S15
302b
UNIT2
S21
Move
OK1
S22
Stop
OK1
REQ1
309
307
SET I01 /* SOL1 ON */
SET TD1, 1000 /* Set 1s timer */
OK1 : I00 == ON &TD1 == OFF
/* LS1 ON & not time-up */
NG1 : I00 == OFF & TD1 == ON
/* LS1 OFF & time-up */
308

FIG. 4

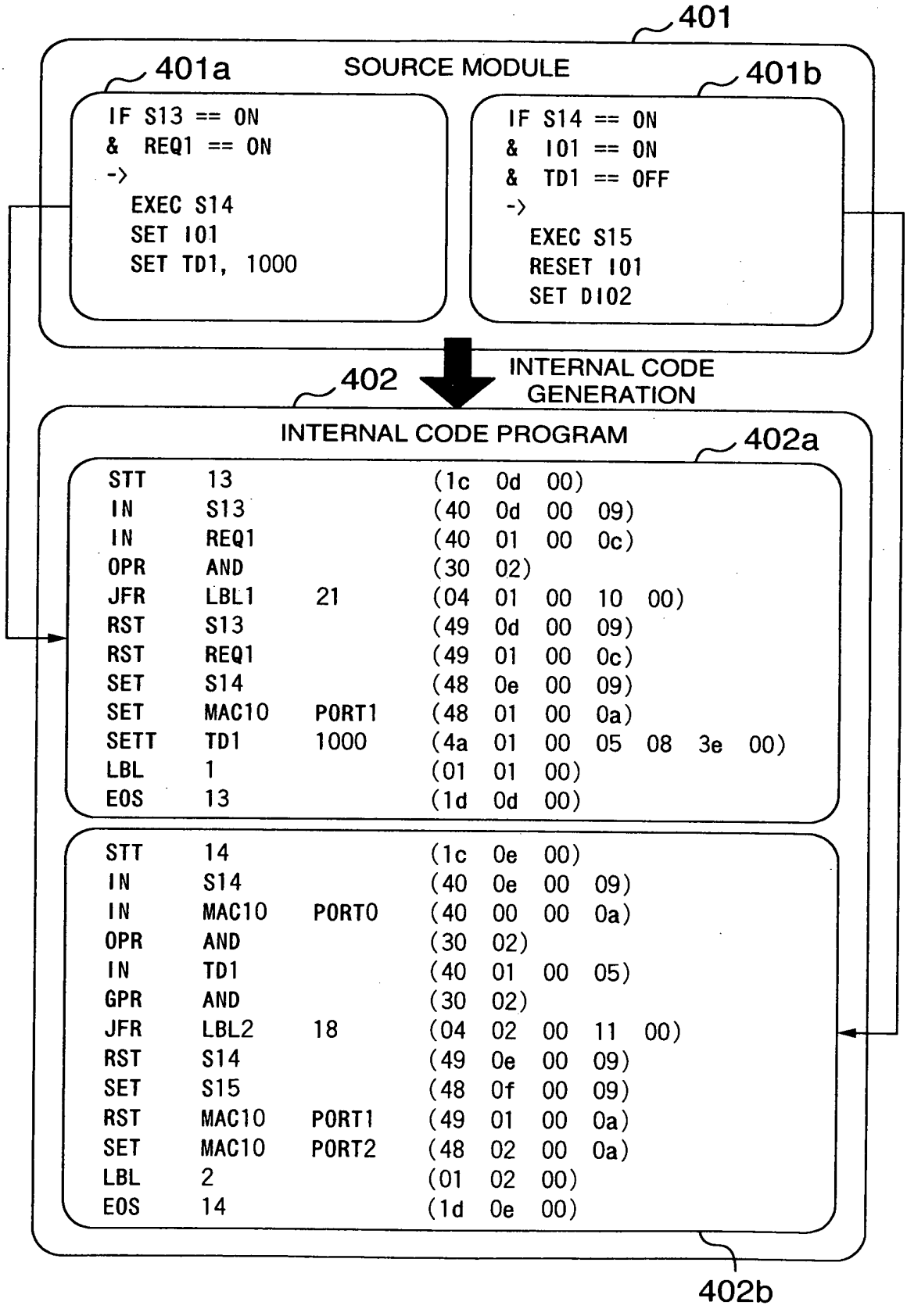

401
401a
SOURCE MODULE
401b
IF S13 == ON
& REQ1 == ON
->
EXEC S14
SET I01
SET TD1, 1000
IF S14 == ON
& I01 == ON
& TD1 == OFF
->
EXEC S15
RESET I01
SET D102
402
INTERNAL CODE GENERATION
INTERNAL CODE PROGRAM
402a
STT 13 (1c 0d 00)
IN S13 (40 0d 00 09)
IN REQ1 (40 01 00 0c)
OPR AND (30 02)
JFR LBL1 21 (04 01 00 10 00)
RST S13 (49 0d 00 09)
RST REQ1 (49 01 00 0c)
SET S14 (48 0e 00 09)
SET MAC10 PORT1 (48 01 00 0a)
SETT TD1 1000 (4a 01 00 05 08 3e 00)
LBL 1 (01 01 00)
EOS 13 (1d 0d 00)
STT 14 (1c 0e 00)
IN S14 (40 0e 00 09)
IN MAC10 PORT0 (40 00 00 0a)
OPR AND (30 02)
IN TD1 (40 01 00 05)
GPR AND (30 02)
JFR LBL2 18 (04 02 00 11 00)
RST S14 (49 0e 00 09)
SET S15 (48 0f 00 09)
RST MAC10 PORT1 (49 01 00 0a)
SET MAC10 PORT2 (48 02 00 0a)
LBL 2 (01 02 00)
EOS 14 (1d 0e 00)
402b

FIG. 5

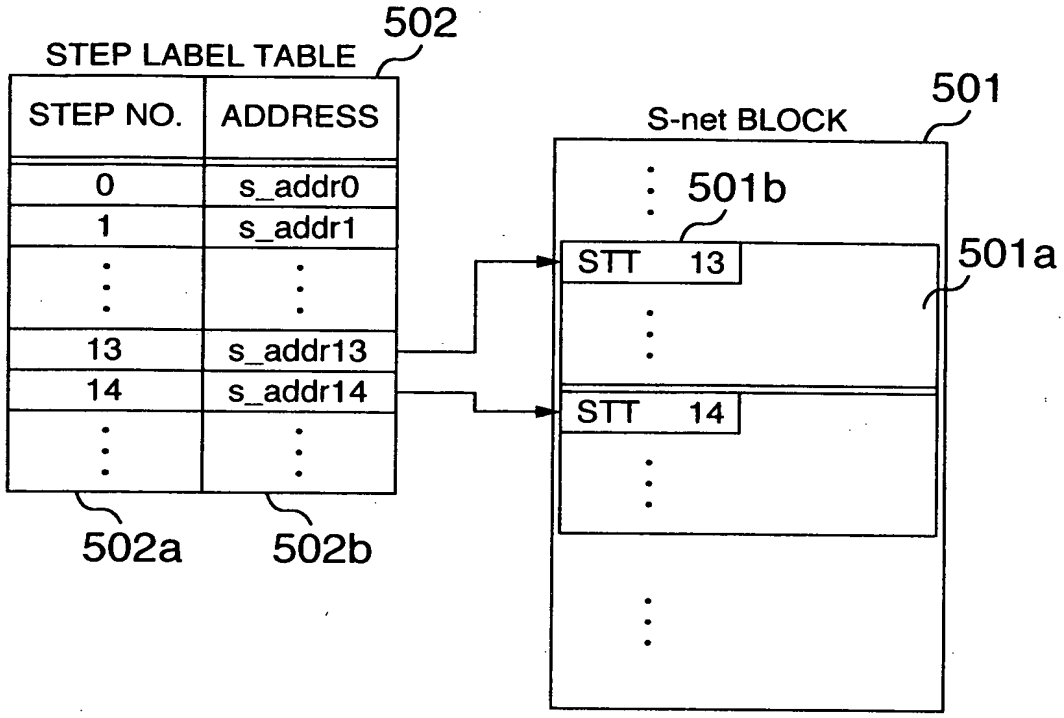

502
STEP LABEL TABLE
STEP NO.
ADDRESS
0
s_addr0
1
s_addr1
13
s_addr13
14
s_addr14
502a
502b
501
S-net BLOCK
501b
501a
STT 13
STT 14

FIG. 6

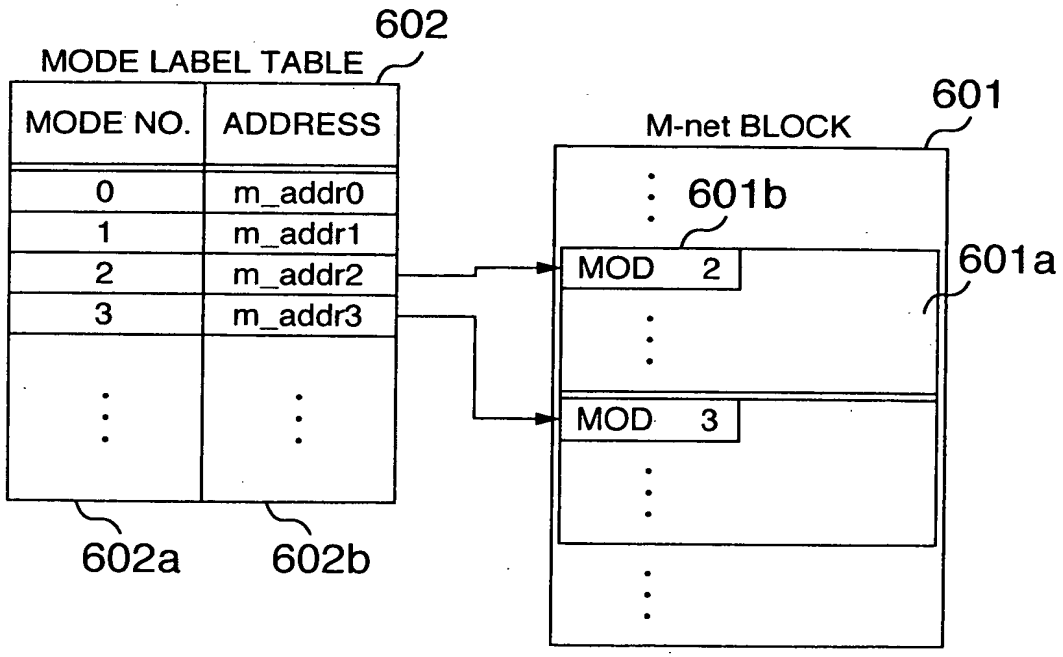

602
MODE LABEL TABLE
MODE NO.
ADDRESS
0
m_addr0
1
m_addr1
2
m_addr2
3
m_addr3
602a
602b
601
M-net BLOCK
601b
601a
MOD 2
MOD 3

FIG. 7

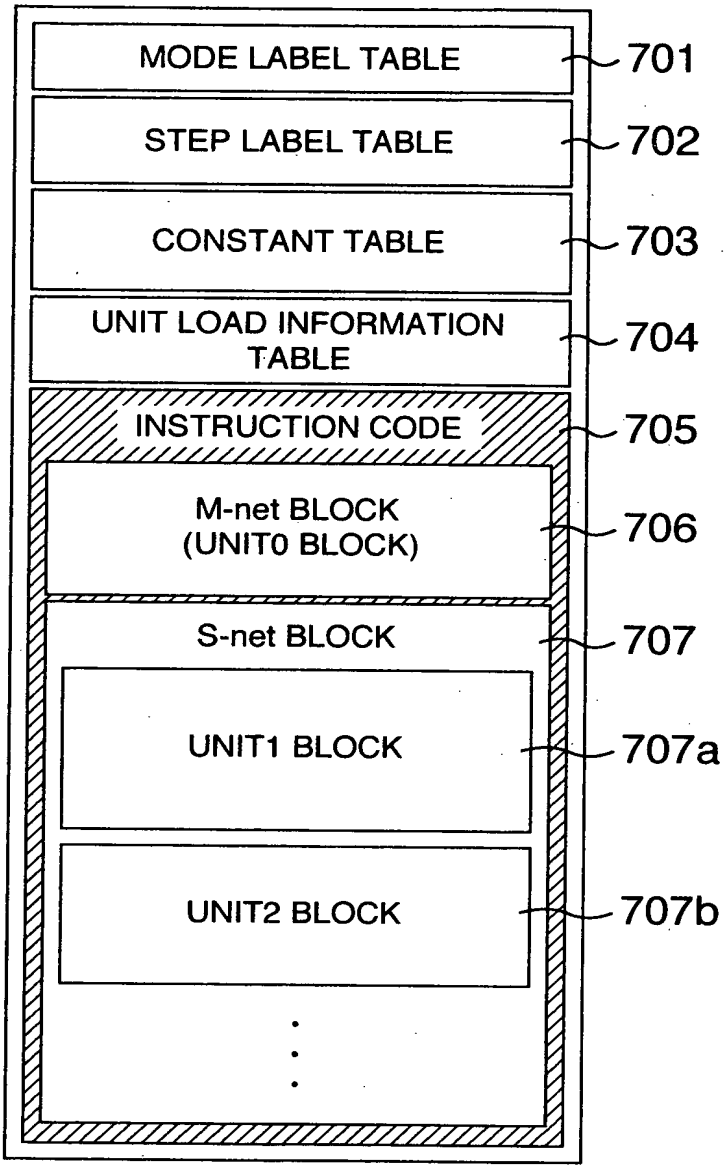


FIG. 9

901 PROCESSOR NO.	902 MAC ID	903 PROCESSOR TYPE
0	0	A
1	1	A
2	2	B

FIG. 8

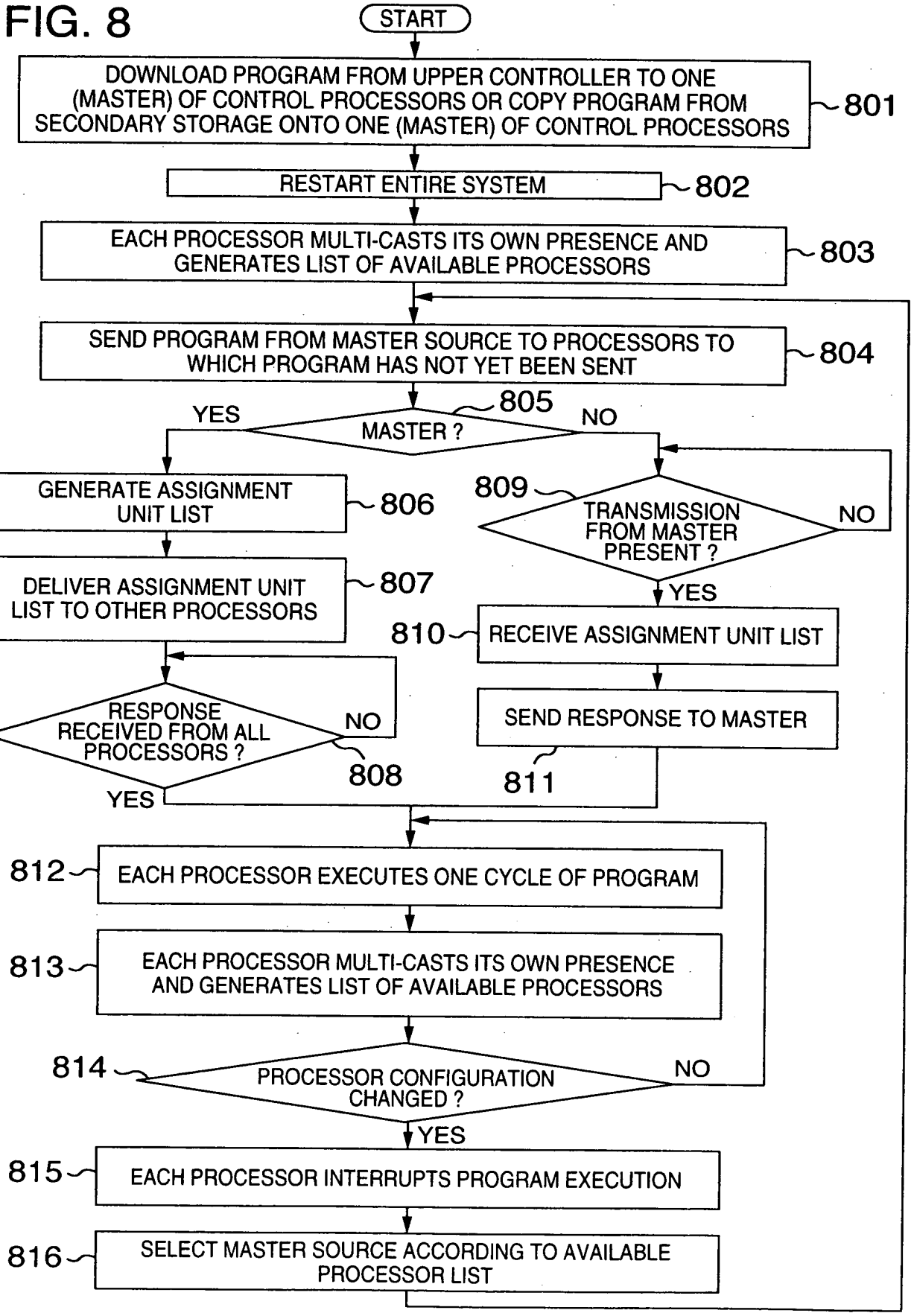

START
DOWNLOAD PROGRAM FROM UPPER CONTROLLER TO ONE (MASTER) OF CONTROL PROCESSORS OR COPY PROGRAM FROM SECONDARY STORAGE ONTO ONE (MASTER) OF CONTROL PROCESSORS
801
RESTART ENTIRE SYSTEM
802
EACH PROCESSOR MULTI-CASTS ITS OWN PRESENCE AND GENERATES LIST OF AVAILABLE PROCESSORS
803
SEND PROGRAM FROM MASTER SOURCE TO PROCESSORS TO WHICH PROGRAM HAS NOT YET BEEN SENT
804
805
MASTER ?
YES
NO
GENERATE ASSIGNMENT UNIT LIST
806
DELIVER ASSIGNMENT UNIT LIST TO OTHER PROCESSORS
807
RESPONSE RECEIVED FROM ALL PROCESSORS ?
NO
808
YES
809
TRANSMISSION FROM MASTER PRESENT ?
NO
YES
810
RECEIVE ASSIGNMENT UNIT LIST
SEND RESPONSE TO MASTER
811
812
EACH PROCESSOR EXECUTES ONE CYCLE OF PROGRAM
813
EACH PROCESSOR MULTI-CASTS ITS OWN PRESENCE AND GENERATES LIST OF AVAILABLE PROCESSORS
814
PROCESSOR CONFIGURATION CHANGED ?
NO
YES
815
EACH PROCESSOR INTERRUPTS PROGRAM EXECUTION
816
SELECT MASTER SOURCE ACCORDING TO AVAILABLE PROCESSOR LIST

FIG. 10

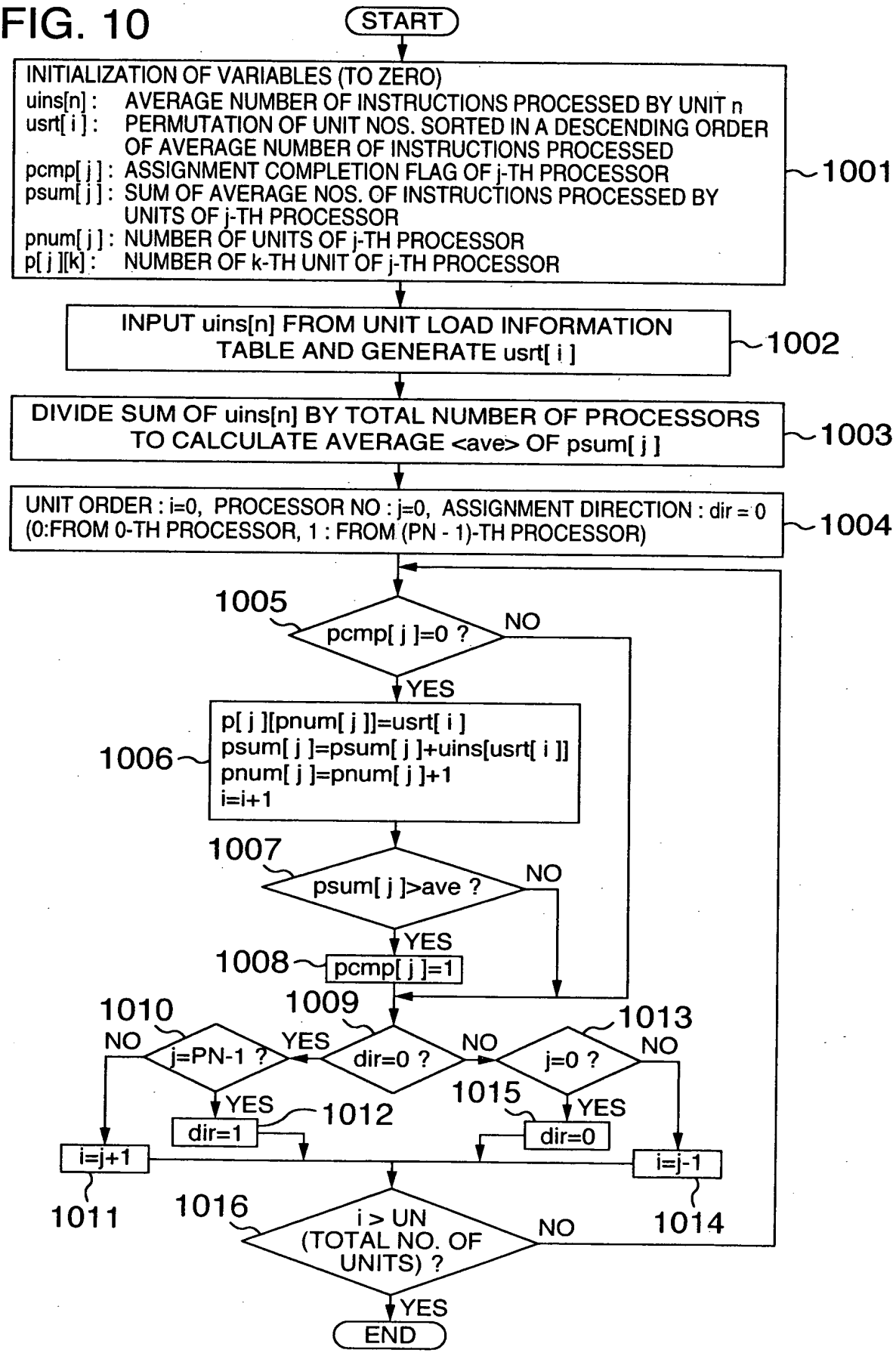

START
INITIALIZATION OF VARIABLES (TO ZERO)
uins[n] : AVERAGE NUMBER OF INSTRUCTIONS PROCESSED BY UNIT n
usrt[i] : PERMUTATION OF UNIT NOS. SORTED IN A DESCENDING ORDER OF AVERAGE NUMBER OF INSTRUCTIONS PROCESSED
pcmp[j] : ASSIGNMENT COMPLETION FLAG OF j-TH PROCESSOR
psum[j] : SUM OF AVERAGE NOS. OF INSTRUCTIONS PROCESSED BY UNITS OF j-TH PROCESSOR
pnum[j] : NUMBER OF UNITS OF j-TH PROCESSOR
p[j][k] : NUMBER OF k-TH UNIT OF j-TH PROCESSOR
1001
INPUT uins[n] FROM UNIT LOAD INFORMATION TABLE AND GENERATE usrt[i]
1002
DIVIDE SUM OF uins[n] BY TOTAL NUMBER OF PROCESSORS TO CALCULATE AVERAGE <ave> OF psum[j]
1003
UNIT ORDER : i=0, PROCESSOR NO : j=0, ASSIGNMENT DIRECTION : dir = 0 (0:FROM 0-TH PROCESSOR, 1 : FROM (PN - 1)-TH PROCESSOR)
1004
1005
pcmp[j]=0 ?
NO
YES
1006
p[j][pnum[j]]=usrt[i]
psum[j]=psum[j]+uins[usrt[i]]
pnum[j]=pnum[j]+1
i=i+1
1007
psum[j]>ave ?
NO
YES
1008
pcmp[j]=1
1009
1010
1013
NO
j=PN-1 ?
YES
dir=0 ?
NO
j=0 ?
NO
YES
1012
1015
YES
dir=1
dir=0
i=j+1
i=j-1
1011
1016
1014
i > UN (TOTAL NO. OF UNITS) ?
NO
YES
END

FIG. 11

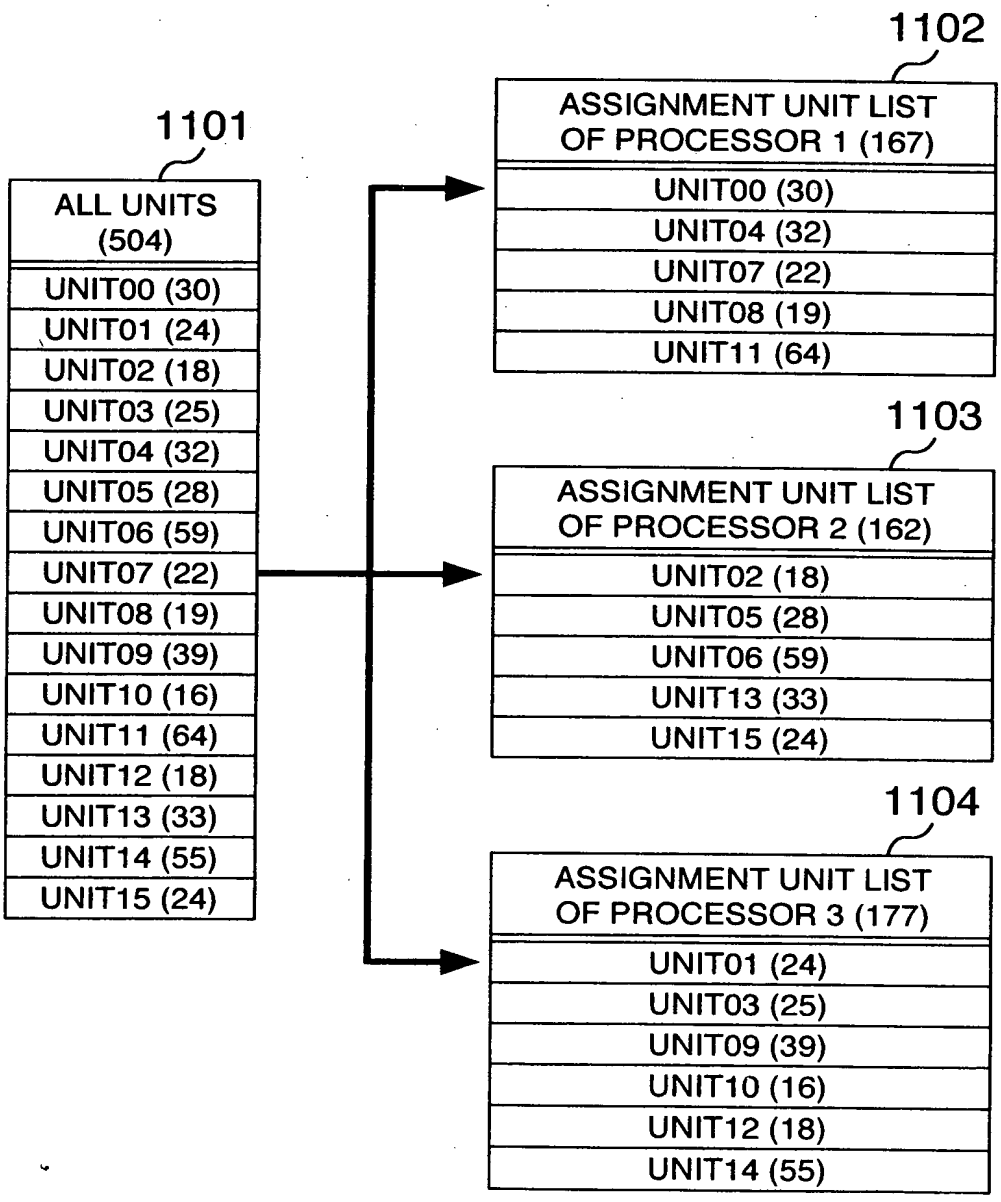

1101
ALL UNITS (504)
UNIT00 (30)
UNIT01 (24)
UNIT02 (18)
UNIT03 (25)
UNIT04 (32)
UNIT05 (28)
UNIT06 (59)
UNIT07 (22)
UNIT08 (19)
UNIT09 (39)
UNIT10 (16)
UNIT11 (64)
UNIT12 (18)
UNIT13 (33)
UNIT14 (55)
UNIT15 (24)
1102
ASSIGNMENT UNIT LIST OF PROCESSOR 1 (167)
UNIT00 (30)
UNIT04 (32)
UNIT07 (22)
UNIT08 (19)
UNIT11 (64)
1103
ASSIGNMENT UNIT LIST OF PROCESSOR 2 (162)
UNIT02 (18)
UNIT05 (28)
UNIT06 (59)
UNIT13 (33)
UNIT15 (24)
1104
ASSIGNMENT UNIT LIST OF PROCESSOR 3 (177)
UNIT01 (24)
UNIT03 (25)
UNIT09 (39)
UNIT10 (16)
UNIT12 (18)
UNIT14 (55)

FIG. 12

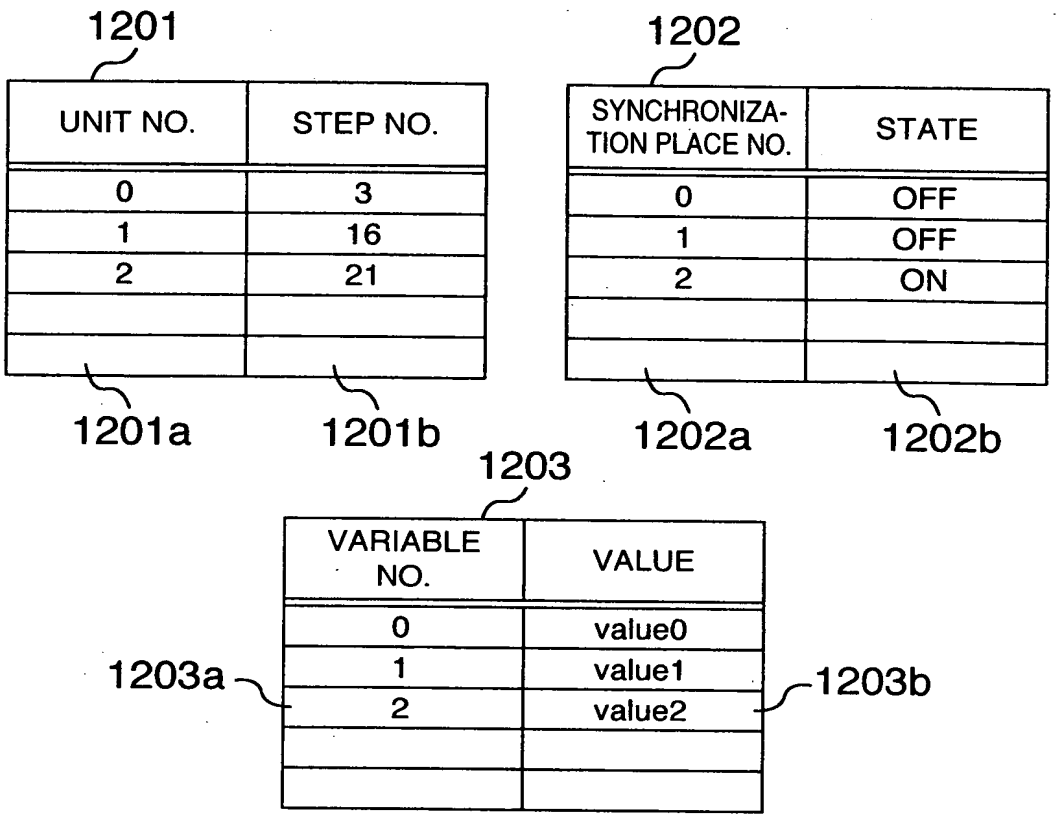

1201
UNIT NO.
STEP NO.
0
3
1
16
2
21
1201a
1201b
1202
SYNCHRONIZA-TION PLACE NO.
STATE
0
OFF
1
OFF
2
ON
1202a
1202b
1203
VARIABLE NO.
VALUE
0
value0
1
value1
2
value2
1203a
1203b

FIG. 13

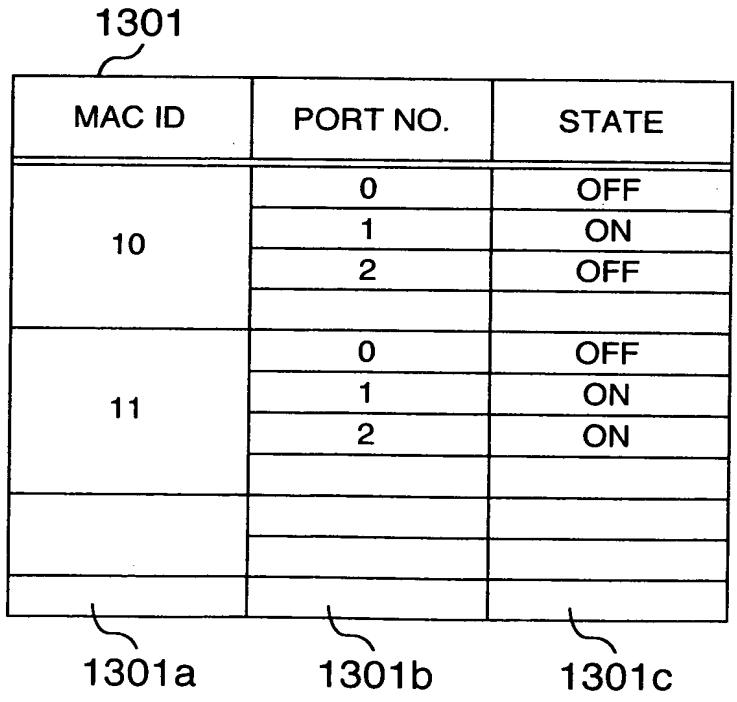
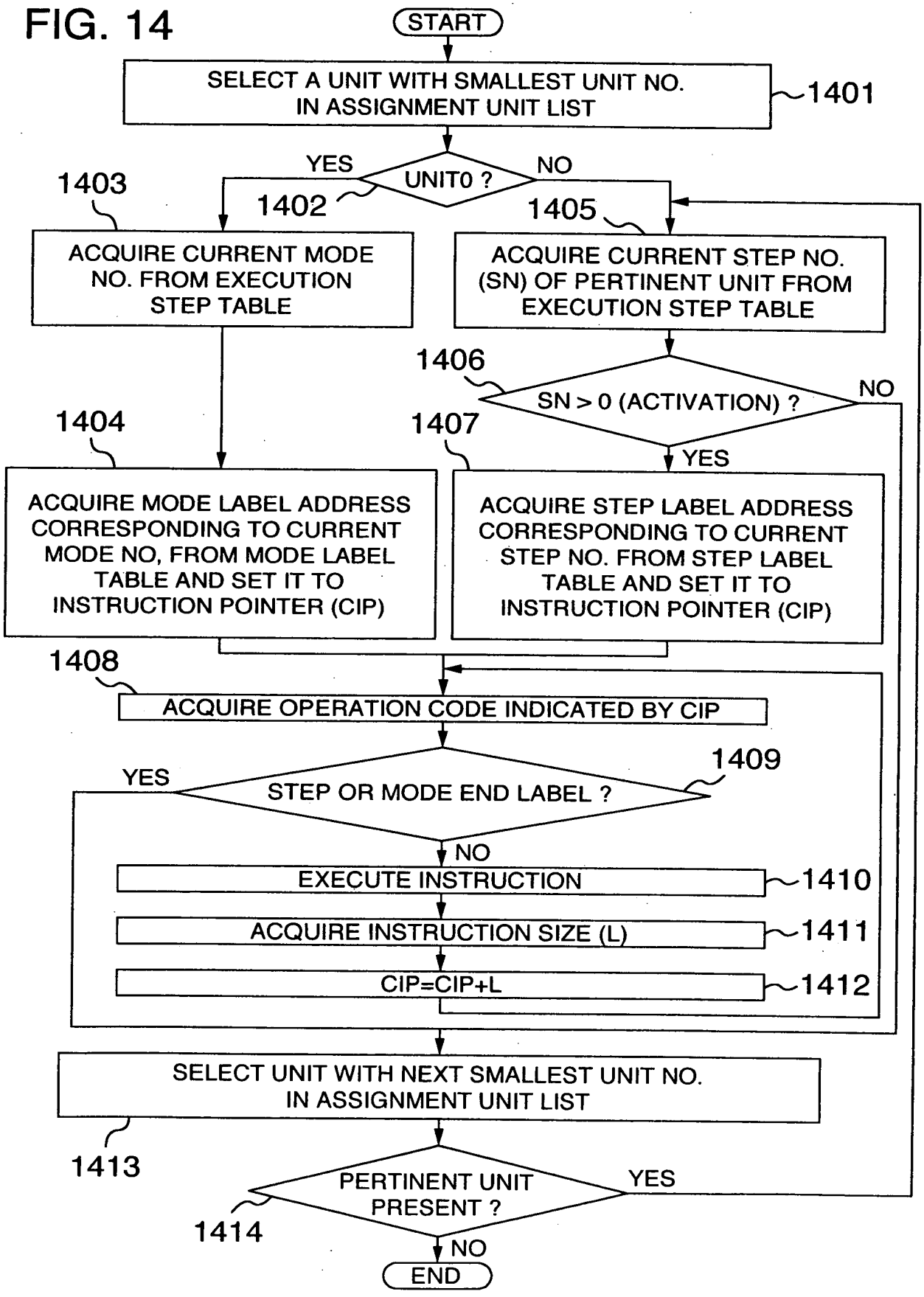

1301
MAC ID
PORT NO.
STATE
10
0
OFF
1
ON
2
OFF
11
0
OFF
1
ON
2
ON
1301a
1301b
1301c

FIG. 14


START
SELECT A UNIT WITH SMALLEST UNIT NO. IN ASSIGNMENT UNIT LIST
1401
UNIT0 ?
YES
NO
1402
1403
1405
ACQUIRE CURRENT MODE NO. FROM EXECUTION STEP TABLE
ACQUIRE CURRENT STEP NO. (SN) OF PERTINENT UNIT FROM EXECUTION STEP TABLE
1406
SN > 0 (ACTIVATION) ?
NO
YES
1404
1407
ACQUIRE MODE LABEL ADDRESS CORRESPONDING TO CURRENT MODE NO, FROM MODE LABEL TABLE AND SET IT TO INSTRUCTION POINTER (CIP)
ACQUIRE STEP LABEL ADDRESS CORRESPONDING TO CURRENT STEP NO. FROM STEP LABEL TABLE AND SET IT TO INSTRUCTION POINTER (CIP)
1408
ACQUIRE OPERATION CODE INDICATED BY CIP
1409
YES
STEP OR MODE END LABEL ?
NO
EXECUTE INSTRUCTION
1410
ACQUIRE INSTRUCTION SIZE (L)
1411
CIP=CIP+L
1412
SELECT UNIT WITH NEXT SMALLEST UNIT NO. IN ASSIGNMENT UNIT LIST
1413
PERTINENT UNIT PRESENT ?
YES
1414
NO
END